Heat Wave

Heat wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the pre-monsoon (April to June) summer season. Heat waves typically occur between March to June, and in some rare cases even extend till July.

Definition Criteria

Heat wave is considered if maximum temperature of a station reaches at least 40°C or more for Plains, 37°C or more for coastal stations and at least 30°C or more for Hilly regions. Following criteria are used to declare heat wave:

a) Based on Departure from Normal
   - **Heat Wave**: Departure from normal is 4.5°C to 6.4°C
   - **Severe Heat Wave**: Departure from normal is >6.4°C

b) Based on Actual Maximum Temperature (for plains only)
   - **Heat Wave**: When actual maximum temperature ≥ 45°C
   - **Severe Heat Wave**: When actual maximum temperature ≥47°C

To declare heat wave, the above criteria should be met at least in 2 stations in a Meteorological subdivision for at least two consecutive days.

Formation

- Heat waves can form in many ways. They often form when high pressure aloft strengthens and remains over a region for several days up to several weeks.
- This is common in summer (in both Northern and Southern Hemispheres) as the jet stream 'follows the sun'. On the equator side of the jet stream, in the middle layers of the atmosphere, is the high pressure area.
- Summertime weather patterns are generally slower to change than in winter. As a result, this mid-level high pressure also moves slowly.
- Under high pressure, the air subsides (sinks) toward the surface. This sinking air acts as a dome capping the atmosphere. This cap helps to trap heat instead of allowing it to lift.
- Without the lift there is little or no convection and therefore little or no convective clouds (cumulus clouds) with minimal chance for rain. The lack of clouds means that an affected area is struck with strong sunlight.
- The end result is a continual build-up of heat at the surface that we experience as a heat wave.

Prevalence & Vulnerability

Heat wave is also called a “silent disaster” as it develops slowly and kills and injures humans and animals nationwide. Higher daily peak temperatures of longer duration and more intense heat waves are becoming increasingly frequent globally due to climate change.
• **Heatwaves are relative to an area’s climate** – temperatures that would constitute a heatwave in one area might not in another location and the health effects on the individual are also relative to a range of risk factors.

• **Affected states** during the Heatwave season - Andhra Pradesh, Telangana, Odisha, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Vidarbha region of Maharashtra, Bihar, Jharkhand and Delhi.

• Heat waves are more frequent over the **Indo-Gangetic plains of India**.

• The combination of exceptional heat stress and a predominantly rural population makes India, vulnerable to heat waves.

• A recent report by the **Intergovernmental Panel on Climate Change (IPCC)** shows that in the Indian subcontinent, global warming impacts have come sooner and hit harder than predicted.

• According to a global report prepared by 27 leading academic institutions, the United Nations and inter-governmental agencies, India saw an increase of 40 million in the number of people exposed to heatwaves from 2012 to 2016 (counting both years).

• Between 1901 and 2007, **India's mean temperature increased by more than 0.5 degree Celsius**. Vulnerability to extremes of heat has steadily risen since 1990 in every region, with 157 million more people exposed to heatwaves in 2017 as compared to year 2000.

### Possible Consequences

• **Health hazards** - According to the National Health Service based in the UK, **heat stroke and heat exhaustion** are the two major risks posed by high-temperature conditions.
  ✓ Continuous and constant exposure to high temperatures could result in **nausea and heat cramps**, resulting in rapid rise of the body temperature.
  ✓ **Dehydration** (absence of adequate water within the body) could also aid in heat exhaustion. Headaches, dizziness and nausea are some of the symptoms.

• **Adverse Effects On Mental Health** - Research has revealed that exposure to high temperatures over a sustained period of time can have a **negative impact on the psychology of a person**.
  ✓ It has also been observed that **crime rates go up** when the temperature rises.
  ✓ Also, higher temperatures lead to **lesser income** as people are unable to devote sufficient time to work due to the heat-associated stress.

• **Infrastructural Damage** - As heat causes metal to expand, heat waves can lead to major infrastructural defects.
  ✓ Power transformers can detonate causing fires.
  ✓ Water lines can burst to cause the loss of water and water shortage.
  ✓ Heat waves can also induce the kinking or buckling of railroads.
  ✓ Highways can melt or develop cracks in extreme heat. For example, two traffic lanes in Oklahoma City, US, had to be closed during the 2006 North American heat wave after they buckled under the heat.

• **Trigger Devastating Wildfires** - When a heat wave is accompanied by an episode of drought that dries out the vegetation, it creates the ideal environment for the break-out of a wildfire or a bushfire.
• **Power Outages** - The sudden spike in electricity consumption challenges the available electricity supplies of the area.

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### Interesting Concepts

Extreme heat alters the density of air, making it thinner. Thin air prevents generation of required ‘lift’, and makes it more difficult for aircraft to take off. Thus, as it gets hotter, planes need progressively longer runways and greater engine power to reach the speed needed to become airborne.

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### Measures/Way-Forward

- **Sensitising States** to the need of preparing and implementing specific Heat Action Plans in line with NDMA’s national guidelines on Heat Wave.
- **Establish Early Warning System and Inter-Agency Coordination** to alert residents on predicted high and extreme temperatures.
- **Capacity building / training programme** for health care professionals at local level to recognize and respond to heat-related illnesses, particularly during extreme heat events.
- **Public Awareness and community outreach**: Disseminating public awareness messages on how to protect against the extreme heat-wave through print, electronic and social media and Information, Education and Communication (IEC) materials.
- **Collaboration with non government and civil society** in building temporary shelters, wherever necessary, improved water delivery systems in public areas and other innovative measures to tackle Heat wave conditions.
- **Knowledge of effective prevention and first-aid treatment**, besides an awareness of potential side-effects of prescription drugs during hot weather is crucial for physicians and pharmacists.
- **Sharing experiences and best practices** to help other stakeholders prepare and implement their Heat Action Plans.
- **Need for Data and Analysis** - As Heat Wave is not a notified disaster at the National level, accurate information and data related to heat wave deaths and illnesses are not available. In order to prepare, and take necessary mitigative action there is need for data on the age group, sex and occupation of those who die of heat wave.
- There is need for a roadmap for **India’s Heat Wave Management planning** in the broader global context of achieving the Sustainable Development Goals (SDGs).

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### Heat Action Plan

- A heat-wave action plan aims to provide a framework for planning, implementation, coordination and evaluation of extreme heat response activities in cities/towns that reduces the negative impact of extreme heat on the health of the population.
The plan’s primary objective is to **alert those at risk of heat-related illness** in places where extreme heat conditions either exist or are imminent.

Ahmedabad was among the first city to prepare a Heat wave Action Plan in 2015. This plan provides a framework for other Indian cities to emulate and help protect their citizens from the extreme heat.

**Case Study - Nagpur**

- Through the exemplary leadership of Maharashtra’s Public Health Department and the Nagpur Municipal Corporation, the Nagpur Regional HAP has coordinated between Nagpur and four neighbouring cities, **creating the first regional approach** to heat wave planning in India.
- **Nagpur has also identified particularly vulnerable populations**, such as children and the elderly. There has been tremendous publicity about the HAP in Nagpur.
- **Citizens are actively involved with the HAP** and have carried out awareness marches. These cities are also using social media platforms such as WhatsApp to spread awareness and document the actions taken.
- Recently, Nagpur has also been identified by the Department of Science and Technology under the **National Mission on Strategic Knowledge for Climate Change (NMSKCC)** for the development and testing of a robust and scientific Heat Action Plan.
- Under this initiative, **a more scientific approach** will be incorporated into the city’s existing HAP. Climate data from the last 15-20 years will be **correlated with the mortality and morbidity data** of Nagpur city to prepare a **heat stress index** and **city-specific threshold**.
- Vulnerable areas and population will be identified by **using GIS and satellite imagery for targeted actions**.
- A system will be developed for monitoring the implementation and measuring the impact of heat action plan in mortality and morbidity.

The increased occurrences and severity of heat-wave is a wake-up call for all agencies to take necessary action for prevention, preparedness and community outreach to save the lives of the general public, livestock and wildlife.

As global warming and rising temperatures are affecting communities and regions, particularly in central India, it has become imperative to support city administrations to prepare, activate and update their HAPs with each season and develop capacity both in handling periods of extreme heat as well as making communities both aware of and resilient to the impacts of the changing climate.